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External rendered finishes

The choice of a rendering mix and type of finish must be determined by the required performance and appearance, by the characteristics of the background to which the rendering is to be applied and by the degree of exposure to wind, rain and atmospheric pollution. This digest shows, with the aid of tabulated summaries, how these factors can be assessed and how a suitable specification can then be selected; it summarises the information and recommendations in British Standard Code of Practice BS 5262:1976 and gives some information on textured finishes based on organic media and on some recently developed renderings.

Performance requirements

A wall may be rendered to exclude rain or merely to improve its appearance. Generally, a rendering should combine both functions, although their relative importance may vary. Resistance to rain penetration is likely to be the overriding requirement on a solid wall but on a wall of properly designed cavity construction with a durable external leaf, the applied finish need only be decorative. However, if the external leaf is of lightweight concrete, the rendering will also be required to keep this dry to minimise heat loss and prevent risk of frost damage. Reduction of heat loss may even be the main functional requirement for special renderings containing lightweight aggregate instead of sand.

The degree of resistance to damage by abrasion or impact that is required of a rendering varies with its situation, particularly in relation to adjacent driveways or footpaths. This requirement affects both the strength of mix and the type of finish that are appropriate, since rough textured finishes are more liable to damage than smooth finishes.

Cement-based finishes

Plain coat A smooth and level surface finished with a wood, felt, cork or other suitably faced float. A steel trowel should not be used and over-working should be avoided to minimise the risk of crazing.

Scraped or textured Treatment of the surface of the final coat, at the appropriate stage of setting, with different tools can produce a variety of finishes, depending on the artistry and skill of the craftsman.

Roughcast, wet-dash or (Scottish) harling A rough finish produced by throwing on a wet mix containing a proportion of coarse aggregate.

Dry-dash or pebble-dash A rough finish of exposed pebbles or crushed stone, produced by throwing the aggregate on to a freshly applied coat of mortar.

Machine applied (*eg tyrolean*) The final coat is thrown or spattered on by a machine. The texture is determined by the type of machine and the mix, which is often a proprietary material. Some mixes are self-coloured.

Other finishes

Other types of finish, based on a variety of organic binders, range from imitation stone paints and sand textured paints to coloured thick-textured compositions applied by spraying, usually by specialist contractors. They may be used as a decorative finish on a cement-based undercoat or applied directly to suitable backgrounds, such as certain types of blockwork and cast concrete. The cement-based undercoat should be three to four weeks old before applying organic finishes. The life of organic renderings is less than that of cement-based types and may need maintenance at intervals of between seven and fifteen years.

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Background characteristics

The characteristics of the background to which the rendering is to be applied are of the utmost importance when deciding upon the mixes to be used, the number of coats and the type of finish.

Strength The strength of the background should be adequate to restrain shrinkage or thermal movements of the rendering. Such movements of strong rendering mixes on relatively weak backgrounds may pull the surface off the wall.

Porosity and suction These affect the adhesion of the rendering and influence the choice of the type of mix and the method of application.

Mechanical key If the nature of the background does not afford sufficient key it may be necessary to fix metal mesh, roughen the surface or apply a spatter coat or bonding medium.

Resistance to rain penetration and frost damage Backgrounds that are impermeable to rain and resistant to frost, even without a rendering, allow a wider choice than those backgrounds that need protection by a rendering.

Other properties If the background contains soluble sulphate salts and remains wet for long periods, chemical action between the salts and cement in the mortar or rendering may result in cracking, disintegration or loss of adhesion of the rendering. On such backgrounds, proper detailing of architectural features is essential to prevent penetration of water behind the renderings. Walls at ground level below the dpc, retaining walls, chimney stacks etc, where dampness cannot be avoided are best left without a rendering to aid drying, but if they must be rendered, sulphate-resisting cement should be used.

Background types

Solid backgrounds These vary considerably in strength, suction and mechanical key and can be subdivided as follows:

Dense, strong and smooth Includes walls of dense clay or concrete bricks and blocks, dense concrete and closed-surface lightweight-aggregate concrete. They have low porosity and little suction and frequently have smooth surfaces, offering little mechanical key, so that some treatment to improve the bond is often necessary. Bush hammering, fixing metal mesh or the application of a spatterdash key coat are normally satisfactory.

Moderately strong and porous Most clay, calcium silicate or concrete bricks and blocks and some medium density concrete. These backgrounds normally afford some suction and mechanical key and hence provide a satisfactory bond.

Moderately weak and porous Open-surface lightweight-aggregate concrete, aerated concrete and some relatively weak bricks. More care is needed in selecting renderings for such backgrounds, since the shrinkage of unduly strong renderings is liable to lead to shearing of the surface of the background.

No-fines concrete Forms a class by itself, having low suction and a positive mechanical key. It generally has sufficient strength to resist shrinkage stresses imposed by the rendering, and the risk of capillary transmission of water is very small.

Slab backgrounds The only type of slab background likely to require rendering is woodwool, either fixed over studding or used as permanent formwork for concrete. The material affords a good mechanical key but is weak and cannot, when unrestrained, resist undue stresses imposed by moisture movements of the rendering. The slabs themselves have a considerable moisture movement and should therefore be completely dry when rendered.

Metal lathing Expanded metal lathing or welded wire mesh backgrounds for external rendering are normally used on framed construction. Three-coat work is essential, with a dense and relatively impervious first coat to prevent rusting of the lathing and provide the necessary resistance to rain penetration. An exception can be made when mixes containing alkali-resistant glass fibre applied to galvanised lathing are used. A single coat is sufficient to provide weather resistance but if a flat surface is essential a second coat will probably be needed; it should be applied the day after the first coat.

Mixes

Table 1 gives mix compositions and Table 2 shows the recommended mixes in relation to the background, the type of finish required and the degree of exposure. Where alternative mixes are given, the following considerations should guide the choice:

(a) The type of mix shown in bold type is to be preferred. The mix for each successive coat should never be of a type richer in cement than the coat to which it is applied.
(b) The type of mix richer in cement is to be preferred when it is applied under winter conditions.

Type I mixes These produce strong, relatively impervious renderings with a high susceptibility to shrinkage cracking. Their use should be restricted to strong backgrounds and for the following applications:

(a) First coats on metal lathing or no-fines concrete backgrounds.
(b) Roughcast or dry-dash finishes.
(c) Special abrasion resistant applications such as plinths etc.

Type II, III, IV mixes These are likely to provide satisfactory results in most types of rendered finish under most conditions. They are more porous than Type I; Type III and IV especially are less susceptible to shrinkage cracking and crazing. Their strength is adequate for the conditions indicated in the table,

Table 1 Mixes suitable for rendering

Mix type	Cement: lime: sand	Cement: ready-mixed lime: sand		Cement: sand (using plasticizer)	Masonry cement: sand
		Ready-mixed lime: sand	Cement: ready-mixed material		
I	1 : $\frac{1}{4}$: 3	1 : 12	1 : 3	—	—
II	1 : $\frac{1}{2}$: 4 to 4$\frac{1}{2}$	1 : 8 to 9	1 : 4 to 4$\frac{1}{2}$	1 : 3 to 4	1 : 2$\frac{1}{2}$ to 3$\frac{1}{2}$
III	1 : 1 : 5 to 6	1 : 6	1 : 5 to 6	1 : 5 to 6	1 : 4 to 5
IV	1 : 2 : 8 to 9	1 : 4$\frac{1}{2}$	1 : 8 to 9	1 : 7 to 8	1 : 5$\frac{1}{2}$ to 6$\frac{1}{2}$

NOTE. In special circumstances, for example where soluble salts in the background are likely to cause problems, mixes based on sulphate-resisting Portland cement or high alumina cement may be employed. High alumina cement should not be mixed with lime, ground limestone, ground chalk; silica flour or other suitable inert filler should be employed instead.

Table 2 Recommended mixes for external renderings in relation to background materials, exposure conditions and finish required

NOTE. The type of mix shown in bold type is to be preferred.

Background material	Type of finish	First and subsequent undercoats			Final coat		
		Exposure			Exposure		
		Severe	Moderate	Sheltered	Severe	Moderate	Sheltered
(1) Dense, strong, smooth	Wood float	II or III	II or III	II or III	III	III or IV	III or IV
	Scraped or textured	II or III	II or III	II or III	III	III or IV	III or IV
	Roughcast	I or II	I or II	I or II	II	II	II
	Dry dash	I or II	I or II	I or II	II	II	II
(2) Moderately strong, porous	Wood float	II or III	III or IV	III or IV	III	III or IV	III or IV
	Scraped or textured	III	III or IV	III or IV	III	III or IV	III or IV
	Roughcast	II	II	II	as undercoats		
	Dry dash	II	II	II			
(3) Moderately weak, porous*	Wood float	III	III or IV	III or IV			
	Scraped or textured	III	III or IV	III or IV			
	Dry dash	III	III	III	as undercoats		
(4) No fines concrete†	Wood float	II or III	II, III or IV	II, III or IV	II or III	III or IV	III or IV
	Scraped or textured	II or III	II, III or IV	II, III or IV	III	III or IV	III or IV
	Roughcast	I or II	I or II	I or II	II	II	II
	Dry dash	I or II	I or II	I or II	II	II	II
(5) Woodwool slabs*‡	Wood float	III or IV	III or IV	III or IV	IV	IV	IV
	Scraped or textured	III or IV	III or IV	III or IV	IV	IV	IV
(6) Metal lathing	Wood float	I, II or III	I, II or III	I, II or III	II or III	II or III	II or III
	Scraped or textured	I, II or III	I, II or III	I, II or III	III	III	III
	Roughcast	I or II	I or II	I or II	II	II	II
	Dry dash	I or II	I or II	I or II	II	II	II

*Finishes such as roughcast and dry dash require strong mixes and hence are not advisable on weak backgrounds.
†If proprietary lightweight aggregates are used, it may be desirable to use the mix weaker than the recommended type.
‡Three-coat work is recommended, the first undercoat being thrown on like a spatterdash coat.

although the mixes lowest in cement content may not be sufficiently hard to deter vandals or withstand severe abrasion.

Spatterdash mixes The composition of mixes for spatterdash coats used to provide a key on smooth backgrounds or to serve as an impermeable first coat in conditions of severe exposure should be related to the suction of the backgound. If there is some suction the mix should consist of one part by volume of cement and two parts of clean, fairly coarse sand, mixed with sufficient water to give a thick slurry. This should be dashed on with a trowel or scoop to give a thin coating with a rough texture. This coat should be kept damp initially, and then allowed to dry slowly and harden before the undercoat is applied.

On backgrounds with negligible suction a suitable mix consists of one part of cement and 1$\frac{1}{2}$ to two parts of clean sharp sand gauged to a thick slurry with water to which a proportion of a PVA emulsion has been added as recommended by the manufacturer. The mixture should be brushed into the surface and stippled with a bannister or similar brush to form a deep, close textured key. This type of spatterdash coat should be allowed to dry slowly and harden before the undercoat is applied.

Sand An important constituent of any rendering mix is the sand or fine aggregate; its choice affects the working properties of the mix, its water demand and the performance and appearance of the finished rendering. A well-graded sand, preferably complying with BS 1199, is desirable for all rendering mixes, but the performance of an aerated rendering mix appears to be especially sensitive to the grading of the sand and to the suction of the background. The suction of the background results in a loss of water by the mix and the bubble structure tends to break down during subsequent working. The sand for an aerated mix should therefore contain sufficient fine material to help stabilise the bubble structure and maintain some workability if the air content falls.

The coarsest and sharpest sand that can be handled should be used for undercoats but the most suitable grading of sand for the final coat will depend upon the finishing treatment. For floated, scraped or dry-dash finishes the same grading as used in the undercoat will be suitable but it may be desirable to screen out the coarse particles for those textured finishes produced by treatment of the freshly applied final coat with a tool. For 'torn' textures, however, a slightly higher proportion of material larger than 5 mm may be needed.

Number and thickness of coats

External renderings should consist of not less than two coats, applied at intervals adequate to allow one coat to dry and shrink before applying the next. One undercoat and a finishing coat are normally adequate but extra coats are necessary on metal lath and woodwool slab backgrounds to level uneven surfaces, to provide a key or increased resistance to rain penetration, or where the finishing coat does not provide a continuous layer (as in some machine-applied finishes). Spatterdash coats are normally 3 mm to 5 mm thick. Undercoats, of the types shown in Table 1, should be between 8 mm and 16 mm thick.

The thickness of a final coat is normally 8 mm to 10 mm as finished, but some of the finer textured machine-applied finishes may be as thin as 3 mm.

When rendering mixes containing alkali-resistant glass fibres are used, the number of coats can generally be reduced by one. A single coat between 5 mm and 8 mm thick is normally adequate for weather protection, but if a second coat is applied, the interval between the two coats should be a day or less and the first coat should be keyed by lightly scratching.

Exposure, appearance and detailing

Table 2 shows that the more severe conditions of exposure allow less choice of mixes for renderings that are required to prevent rain penetration. The column headings of *Severe, Moderate* and *Sheltered* correspond to the exposure gradings described in Digest 127, which are based on driving-rain indices as modified by local conditions and building heights. For such conditions of exposure to prolonged driving rain at least the first coat of the rendering should be as rich in cement as the strength of the background will allow. This requirement may be satisfied by a continuous spatterdash coat used as the first of three coats. Alternatively, recently developed rendering mixes have been found effective for such conditions. These contain alkali-resistant glass fibres that prevent the formation of drying shrinkage cracks in the rendering. This type of rendering is normally applied as a thin (5–8 mm) coat and its overall moisture movements are therefore more easily restrained, even by weak backgrounds, than those of traditional cement-rich renderings.

The degree of exposure to atmospheric pollution must influence the choice of the type of finish and its colour if an acceptable appearance is to be retained. Deposited dirt shows up more on light coloured finishes than on the natural grey cement finish or on darker colours. Dirt also tends to be retained more on heavily textured finishes than on more finely textured or smooth finishes. However, when the design and detailing of the wall tends to produce rain streaks the appearance of smooth finishes is more affected than that of textured finishes which discolour more uniformly. The appearance of rendered finishes can change considerably with time, depending on the type of finish and initial colour, the degree of exposure and atmospheric pollution and the design and detailing of the wall. Discoloration by algae and lichens is common in wet areas.

Detailing is particularly important if streaking is to be avoided, and recommendations for the design of sills, string courses, parapets and other architectural features to minimise streaking and to improve the performance of the rendering are given in BS 5262. If periodic painting is envisaged, smooth finishes will probably be required and careful detailing to prevent rain runs is then particularly important.

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